

Serious adverse events associated with FPV vaccines are rare. Tumor formation at the site of a topically administered vaccine has not been reported. Vaccination of pregnant queens with modified-live FPV vaccines may possibly result in neurologic disease in developing fetuses¹¹; the same concern applies to kittens vaccinated at less than 4 weeks of age. Therefore, the use of MLV vaccines should be avoided in pregnant queens and kittens less than 1 month of age.^{11,12}

Feline viral rhinotracheitis and feline calicivirus infection—Feline viral rhinotracheitis, caused by feline herpesvirus-1 (FHV-1), and feline calicivirus (FCV) infection account for up to 90% of all cases of infectious upper respiratory tract disease in cats.¹³ Both viruses are shed in ocular, nasal, and pharyngeal secretions of infected cats.¹⁴ Organisms are transmitted from cat to cat directly, through sneezed macro-droplets, or indirectly, via contaminated fomites.¹³ The disease is self-limiting; however, infected cats may develop chronic oculonasal disease. Latent infection is lifelong for cats infected with FHV-1; reactivation can occur during periods of stress or following corticosteroid administration. Some cats infected with FCV become persistently infected and shed virus for prolonged periods (months to years). Although rarely serious in adult cats, disease caused by these viruses may be severe, and sometimes fatal, in kittens. Lameness and chronic oral inflammatory syndromes have been linked to calicivirus infection and vaccination with modified-live calicivirus vaccines.¹⁵⁻²⁰ Risk of exposure to either FHV-1 or FCV is high, because both organisms are widespread in the feline population.

*Vaccination against FHV-1 and FCV is **highly recommended** for all cats.* Immunity is through humoral and cell-mediated immune responses to natural infection or vaccination or through passive transfer of maternal antibodies from queen to kittens. Maternal antibody may interfere with induction of a systemic immune response; however, by 12 weeks of age, maternal antibody titers wane sufficiently to allow parenteral immunization. Topically administered (intranasal, conjunctival) vaccines are capable of inducing a local immune response in the face of high maternal antibody titers.²¹ Serologic and challenge exposure data indicate that a parenteral FHV-1 and FCV vaccine induces protection that lasts at least 3 years.^{8,9} *Therefore, following the initial series of vaccinations and revaccination 1 year later, cats should be vaccinated once every 3 years.*

Regardless of the route of administration, FHV-1 and FCV vaccines induce only relative, not complete, protection. At best, these vaccines induce an immune response that lessens the severity of disease; vaccinates are not immune to infection, nor are they protected from all signs of disease.² Currently available FCV vaccines probably do not induce protection from all isolates of the virus.²²

Modified-live virus and inactivated virus vaccines for parenteral administration and MLV vaccines for topical

(intranasal and conjunctival) administration are available. If a susceptible cat is born into or is entering an environment in which viral upper respiratory tract disease is endemic (eg, some catteries, boarding facilities, and shelters), the use of a topical product may be advantageous. Administration of such products to kittens as young as 10 to 14 days of age could be considered in these situations; however, products that also contain modified-live FPV antigens should not be administered to kittens younger than 4 weeks of age.¹² Adverse events associated with vaccination against FHV-1 and FCV include mild transient fever, sneezing, conjunctivitis, oculonasal discharge, lameness, and, for parenteral products, pain at the injection site.^{16,22} Sneezing, conjunctivitis, oculonasal discharge, and ulceration of the nasal philtrum are believed to occur more frequently with vaccines licensed for topical use. Tumor formation at the site of a topically administered vaccine has not been reported.

Rabies—Rabies is transmitted mainly through bite wounds of infected mammals. More cats than dogs develop rabies in the United States,²³ and although relatively resistant to rabies, both species serve as potential sources of infection for human beings.^{23,24} Treatment is ineffective in cats that develop clinical signs and should not be attempted because of the high potential for zoonotic infection.²⁴ All instances of suspected or known rabies virus infection must be reported to local health department officials. Proper precautions and quarantine procedures as outlined by local regulations and described in the "Compendium of Animal Rabies Prevention and Control" should be followed.²⁵

Although vaccine-associated sarcomas have been reported to develop in association with administration of a variety of vaccines, current data suggests they are more frequently associated with administration of feline leukemia virus vaccines and adjuvanted rabies virus vaccines.²⁶ Inflammatory reactions are commonly observed at sites where adjuvanted rabies virus vaccines have been administered, and concern has arisen regarding the possible association between these reactions and vaccine-associated sarcomas.²⁷ With the exception of a recently approved canarypox virus-vectored recombinant feline rabies virus vaccine (PureVax Feline Rabies Vaccine, Merial Ltd), all rabies virus vaccines currently on the market contain adjuvants. In rats, inflammation induced by the recombinant product appears to be minimal,²⁸ but whether the use of this vaccine will be associated with a reduced likelihood of vaccine-associated sarcoma formation in cats is not yet known. The recombinant product is currently licensed only for annual administration.

*Rabies virus vaccination is **highly recommended** for all cats,* and is required by law in some states and municipalities. Manufacturers are required by the USDA to establish, by means of experimental challenge exposure studies, the minimum duration of immunity for rabies virus vaccines they sell, and products approved for use every year or every 3 years are available. Statutes governing the administration of rabies virus vaccines vary considerably